



U.S. AIR FORCE

PROPOSED PLAN FOR FINAL GROUNDWATER AND SOIL REMEDIATION AT FORMER USAF PLANT PJKS WATERTON CANYON, COLORADO



Former Air Force Plant PJKS

December 2011

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INTRODUCTION

The public is invited to review and comment on this Proposed Plan for final groundwater and soil remediation at the Former Air Force Plant Peter J. Kiewit and Sons (PJKS), located in Waterton Canyon, Colorado (**Figure 1**, on following page).

As part of the Order on Consent (State of Colorado, 1998), 56 Solid Waste Management Units (SWMUs), including three groundwater and 53 soil SWMUs, were identified as requiring evaluation for potential contamination. The final remedies for soil sites are complete. The contaminated soil sites were remediated under the Interim Corrective Measures (ICMs) or Interim Removal Actions (IRAs) authorities. The remediation at each soil site was presented for public comment. Regulators approved these interim remedial actions after reviewing and considering all public comments received. Therefore no alternatives for soils will be presented in this Proposed Plan, only a summary of previous investigations and conclusions to document the soil sites in this Proposed Plan and Record of Decision (ROD). Results for each soil SWMU and corresponding recommendations are summarized in Table 1 and closure letters included as Appendix A of the FFS.

A Focused Feasibility Study (FFS) for the proposed groundwater remedy (Shaw, 2010c) is available in the administrative record, under the public review tab, to provide more background and a detailed

PUBLIC COMMENT PERIOD January 12, 2012 – February 25, 2012

Please submit all comments in writing to:
United States Air Force
ASC/WNVR
Attn: Mr. Corey Lam
1801 Tenth Street, Building 8
Wright-Patterson AFB OH 45433

PUBLIC MEETING Date: February 8, 2012 Time: 7:00 – 8:30 p.m.

The public is encouraged to attend a public meeting to discuss the information presented in this Proposed Plan. There will be an opportunity to provide formal comments during the meeting. Representatives from the United States Air Force (USAF) Colorado Department of Public Health and the Environment (CDPHE) and United States Environmental Protection Agency (USEPA) will be on hand to answer questions. The meeting will be held at the following location:

The Peak Foothills Park and Recreation District
6612 S. Ward Street, Littleton, Colorado

Information Repository and Administrative Record
The public is encouraged to review and comment on this Proposed Plan via instructions in text above. For more information, see the Administrative Record located on the internet at:

<http://edm-sepublic.documentservices.dla.mil/>
Hard copies of the documents can be viewed at the information repository maintained at:

Columbine Branch Library
Reference Desk – Former Air Force Plant PJKS

7706 West Bowles Avenue
Littleton, Colorado

discussion on the information presented in this Proposed Plan. The FFS is included in the administrative record and can be accessed via instructions in text box, above.

On November 21, 1989, the United States Environmental Protection Agency (EPA) listed PJKS on the National Priorities List (NPL). (The National Priorities List is a list of some of the nation's most highly contaminated places, commonly referred to as Superfund.) The environmental cleanup work at PJKS is currently

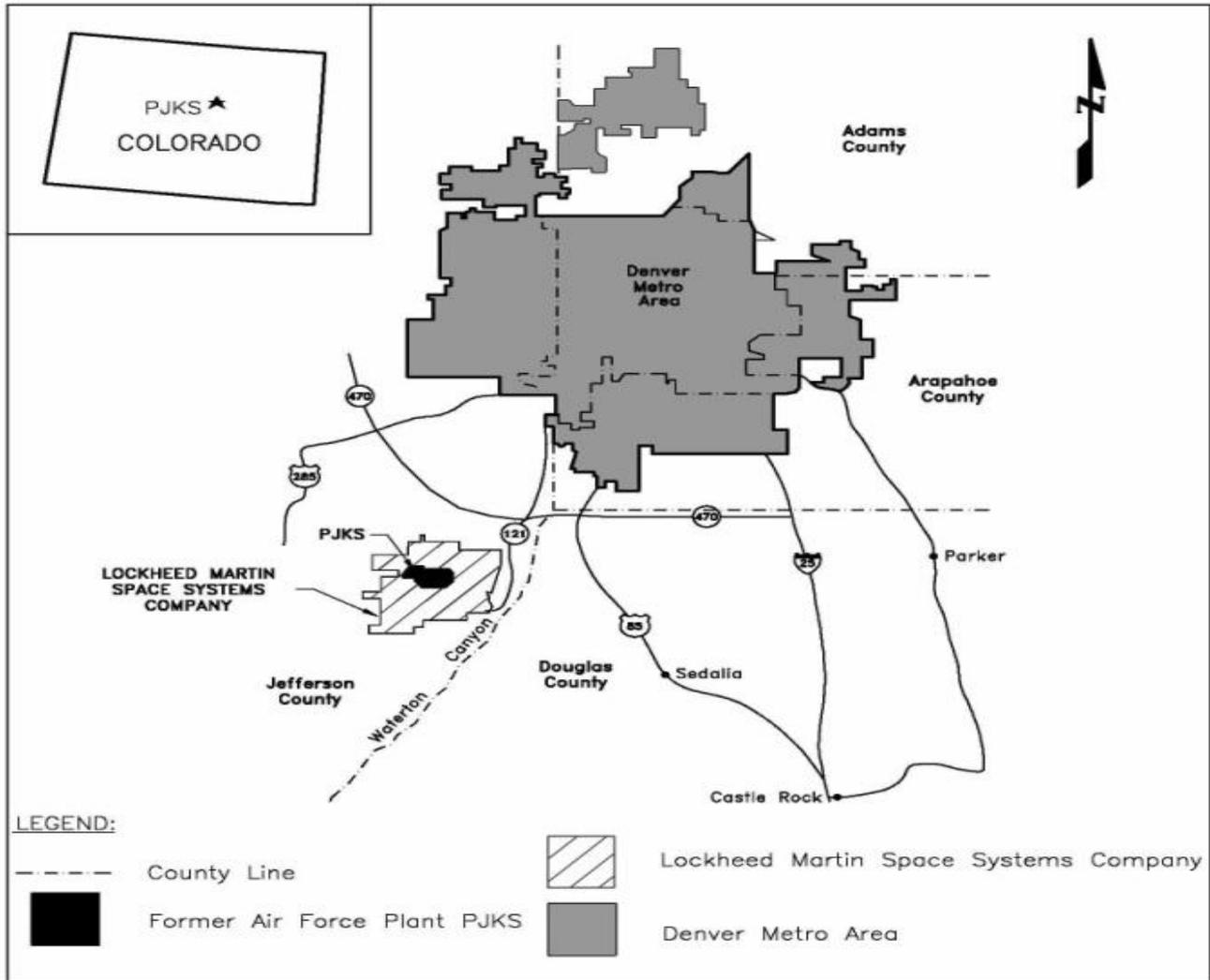


Figure 1: Site Location Map

performed under the United Air Force Center for Engineering and the Environment (AFCEE) contracts. The Aeronautical Systems Center at Wright-Patterson USAF Base, Ohio, manages environmental programs at PJKS. The Colorado Department of Public Health and the Environment (CDPHE) is the lead regulator of the cleanup, with EPA oversight.

This Proposed Plan is required to fulfill public participation requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §117(a) and National Oil and Hazardous Substances Pollution Contingency Plan (NCP) §300.430(f)(2). Following public review of the Proposed Plan, a Record of Decision (ROD)

will be prepared to formally document the selected final remedy and respond to public comments.

The purpose of this Proposed Plan is to:

- Provide basic background information;
- Identify the preferred alternative for remedial action at PJKS and explain the reasons for the preference;
- Describe the other remedial alternatives considered;
- Solicit public review of and comment on all alternatives described; and
- Provide information on how the public can be involved in the remedy selection process.



SITE BACKGROUND

PJKS is a former industrial site located on approximately 460 acres near Waterton Canyon in the Colorado Front Range in Jefferson County, Colorado. The site, which is approximately 20 miles southwest of downtown Denver, is completely surrounded by Lockheed Martin's 5,200-acre Waterton Canyon facility. In 1957, Lockheed Martin deeded the property to the United States Air Force (USAF), which constructed a missile test site at PJKS. The USAF hired Lockheed Martin to be plant operator and prime tenant at PJKS. The PJKS facility was used from 1957 to 1968 as the main test facility for Titan rocket activities, including rocket assembly, engine testing, and research and development. Fuel development, purification, and testing also have taken place on site. Smaller engines and related apparatus have been tested since 1968. The USAF owned the property until February 2001, when ownership was transferred to Lockheed Martin, the long-time operator of the facility. The USAF, however, maintains responsibility for the remediation of PJKS.

SITE CHARACTERISTICS

PJKS is located on the eastern flank of the Front Range. It is situated within an alluvium filled, northwest-trending valley (Central Valley) that is bordered on the west by foothills of the Rocky Mountains, and on the east by parallel hogback ridges consisting of sedimentary rocks. The facility is divided into two geographic areas; the Foothills, which comprise the western two-thirds of the facility and the Central Valley, which covers the eastern one-third of the facility. The foothills are defined by rugged, irregular mountains of igneous and metamorphic rocks and unnamed tributaries of the East and West Fork of Brush Creek. In the Central Valley, the primary geographic features include the main streams of the East and West Forks of Brush Creek, Lariat Creek, and the EPL ridge. Elevations range from 7,000 ft above mean sea level in the foothills in the western portions of the plant to 5,925 ft in the East Fork Brush Creek drainage near the eastern Plant boundary (Parsons, 1999).

Groundwater contamination at PJKS resulted from activities associated with the development of rocket launch equipment, engine testing, and/or fuels development, purification, and testing. The main contaminants of concern (COCs) in groundwater are trichloroethene (TCE), the breakdown products (cis-1,2-dichloroethene [DCE], trans-1-2-DCE, and

vinyl chloride [VC]), 1,1-DCE, and n-nitrosodimethylamine (NDMA). These COCs in groundwater resulted from activities associated with the development of rocket launch equipment, engine testing, and/or fuels development, purification, and testing. COCs in soil were associated with polychlorinated biphenyls (PCBs) and affiliated with industrial processes.

PJKS REGULATORY FRAMEWORK

The environmental cleanup requirements of both CERCLA and the Resource Conservation and Recovery Act (RCRA) apply to investigations and remedial actions at PJKS. The applicability of CERCLA and RCRA regulations to PJKS are outlined in the Order on Consent Number 98-10-08-01 (State of Colorado, 1998), which was signed on December 29, 1998. The Order on Consent is an agreement between the USAF and the CDPHE, Hazardous Materials and Waste Management Division. All state and federal corrective action regulations applicable to PJKS, including CERCLA, Defense Environmental Restoration Program (DERP), RCRA, NCP, and Colorado Hazardous Waste Act (CHWA), were merged in this agreement. The Order on Consent further provides for the integration of RCRA and CERCLA provisions as outlined in 42 United States Code (USC), Paragraph 6905b. The Order on Consent recognizes CDPHE as the lead regulatory agency for PJKS. Any site determination will comply with CERCLA, RCRA and State of Colorado regulations, such as the CHWA. In order to meet the intent of the CERCLA and RCRA corrective action program requirements, the CERCLA model for identifying and evaluating requirements is used in this report.

CERCLA and RCRA Process

For further information on the CERCLA and RCRA process refer to USEPA's website, www.epa.gov

SUMMARY OF ENVIRONMENTAL INVESTIGATIONS

As part of the Order on Consent (State of Colorado, 1998), 56 Solid Waste Management Units (SWMUs), including three groundwater and 53 soil SWMUs (see **Figures 2 and 3**), were identified as requiring evaluation. The following sections describe the investigations and results.

Groundwater SWMUs:

Numerous investigations have been completed at the groundwater SWMUs between 1986 and 2009. Primary investigations included the remedial investigation/feasibility study (RI/FS), the Supplemental RI (SRI) completed in 1999 (Parsons Engineering Science, Inc. [Parsons], 1998 and 1999), Supplemental Remedial Investigation Addendum, Operable Unit (OU) 4 - Lariat Gulch Groundwater Plume (Stone & Webster 2001), Supplemental Remedial Investigation Addendum,

OU5 - Brush Creek Groundwater Plume (Shaw 2003), Brush Creek/Lariat Gulch Groundwater Plumes Pilot Study (Shaw, 2007), Groundwater Treatment Studies Report, NDMA with TCE (Shaw, 2008), and the 2009 Annual Groundwater Monitoring Report (Shaw, 2010b). These investigations show that past operations resulted in three groundwater plumes (SWMUs 1-3, see **Figure 2**) moving from bedrock aquifers into the alluvial aquifer.

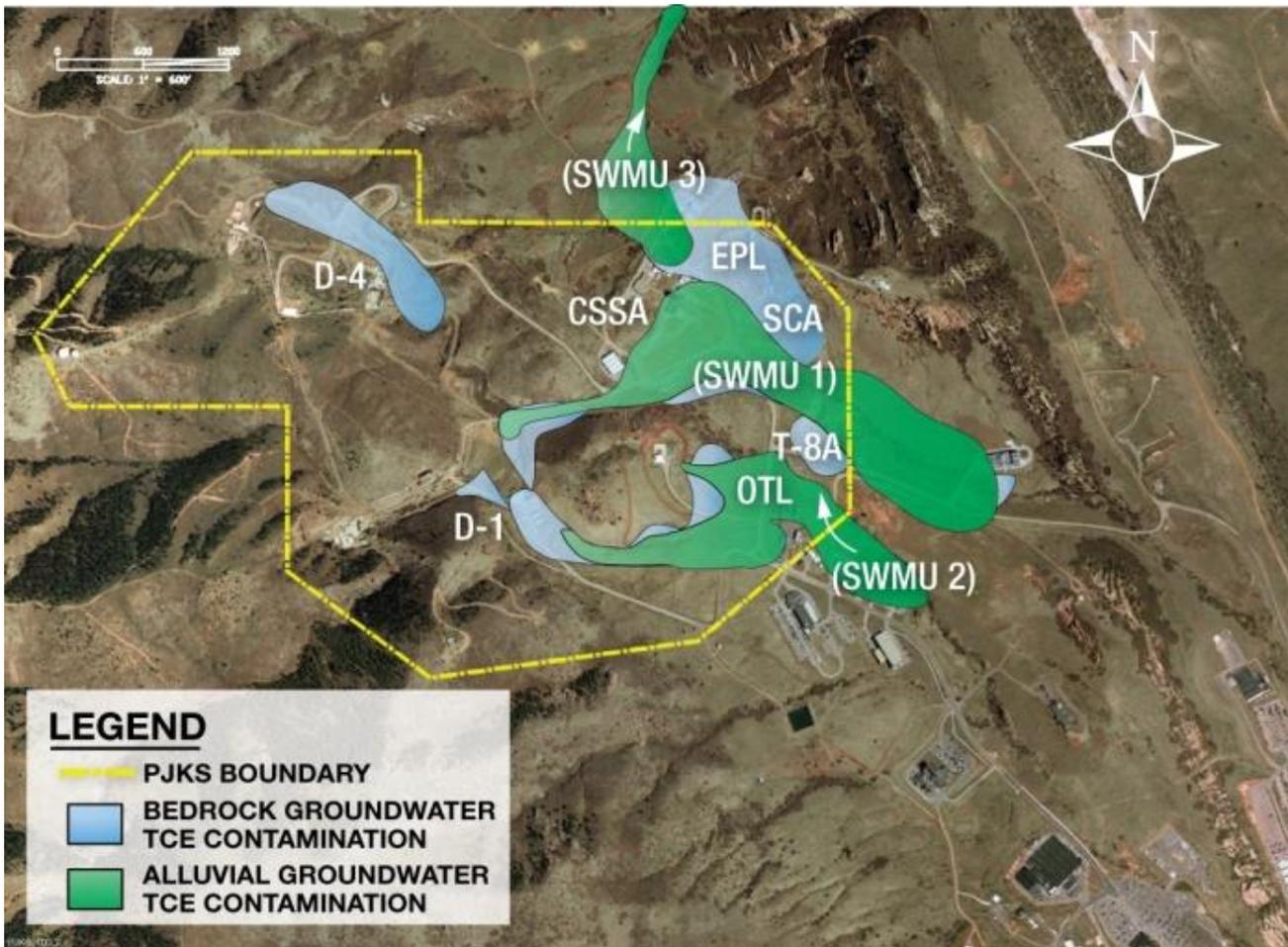


Figure 2: Groundwater SWMUs and Source Areas

The results of these reports were used to determine the location of seven bedrock groundwater contaminant source areas and the lateral extent of the groundwater contaminant plumes of TCE and NDMA (Figure 2). The seven source areas and the contaminants are presented in Table 1.

Soil SWMUs:

A number of investigations have been completed for the soil SWMUs; including a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) in the 1990s, a comprehensive Supplemental Remedial Investigation (SRI) report in May 1999 (Parsons, 1998 and 1999) and most recently, the Combined Soils Investigation (CSI) (Shaw, 2005b). The results of these and other previous investigations were used to support cleanup decisions of No further Action (NFA)/Unrestricted Closure for 37 of the soil SWMUs. Sixteen of the soil SWMUs

Table 1: Seven Groundwater Source Areas

Source Area	Contaminant
D-1 Area (D-1)	TCE, NDMA
Systems and Components Area (SCA)	TCE, NDMA
Engineering Propulsion Laboratory (EPL)	TCE
Central Support Storage Area (CSSA)	TCE, NDMA
Ordnance Testing Laboratory (OTL)	TCE
Source Area	Contaminant
T-8A Pumphouse (T-8A)	TCE, NDMA
D-4 Fuel Storage Area (D-4)	TCE

(Figure 3) required a Restricted Closure and the establishment of land use controls (LUCs) because the soil values are either 1) greater than the residential standard and less than industrial standard or 2) greater than the industrial standard and have a limited cover (either concrete or asphalt) in place. Table 2 summarizes the final actions taken at each soil site.

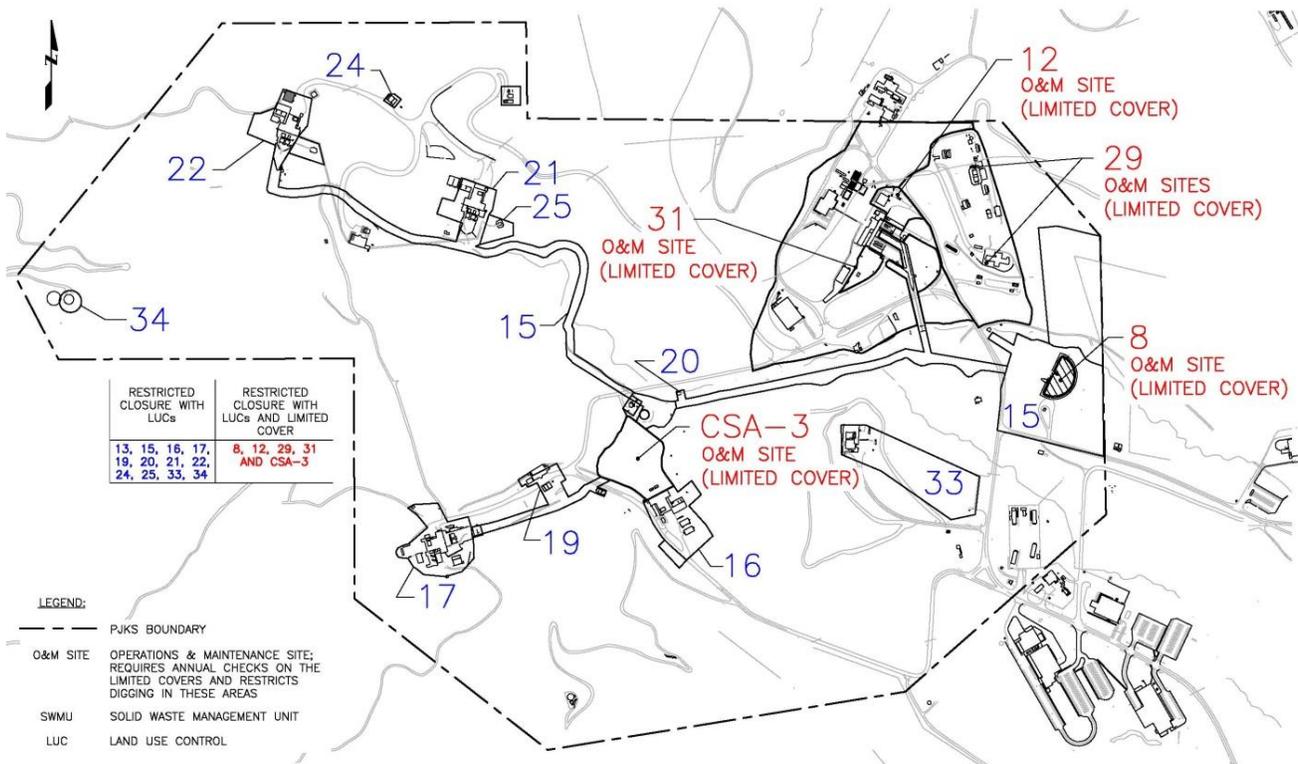


Figure 3: Soil SWMUs with Restricted Closure



Table 2: Final Action for Solid Waste Management Unit (SWMU) Soil Sites

Unrestricted Closure	Restricted Closure with LUCs ⁽¹⁾	Restricted Closure with LUCs and Limited Cover ⁽²⁾
4, 5, 6, 7, 9, 10, 11, 14, 18, 23, 26, 27, 28, 30, 32, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56	13, 15, 16, 17, 19, 20, 21, 22, 24, 25, 33, 34	8, 12, 29, 31, and CSA-3

(1) soil values greater than the residential standard and less than industrial standard or

(2) soil values greater than the industrial standard and have a limited cover (either concrete or asphalt) in place.

SUMMARY OF SITE RISKS

Risks from site contaminants to both humans and wildlife were evaluated.

Groundwater:

PJKS is currently an industrial site with no residential inhabitants. Therefore, under current and reasonable future conditions, people who could be exposed to contaminated water from PJKS would be commercial/ industrial workers. Because future land use is indefinitely restricted at PJKS and the surrounding property, commercial/industrial workers are also identified as future site users.

Three potential routes of exposure to groundwater were evaluated for current and future site users at PJKS: 1) drinking of groundwater, 2) breathing of TCE vapors from groundwater, and 3) handling groundwater. These three routes of exposure are not believed to cause significant risk for the following reasons.

- Groundwater in the area is not a drinking water source.
- COCs in groundwater are blocked or dissipate before workers could be exposed to them by breathing them.
- It was determined that there is a slight possibility for workers to come into contact with groundwater during construction activities, however, this potential is negligible due to the worker protection

program that screens areas with shallow groundwater and restricts access.

Groundwater has been screened against Colorado Basic Standards for Groundwater (CBSGs), which are established to be protective of human health and waters of the State of Colorado (State of Colorado Regulation 41, Title 5, CCR 1002-41). TCE, its daughter products, 1,1- Dichloroethene, and Vinyl Chloride (VC) are in exceedence of the CBSGs. In addition to TCE, N-nitrosodimethylamine (NDMA) concentrations have exceeded the CBSGs. **Table 3** summarizes the analytical concentration ranges in groundwater at each of the source areas from September 2009 (data was collected as part of the Groundwater Performance Monitoring of the ICMs). Contaminants of potential concern in groundwater at the site, are inaccessible to both land and water dwelling species at the site and do not pose a risk.

Table 3: Groundwater Contaminants of Concern (COC) Concentrations at the Seven Source Areas

Source Area	Contaminant	Range of Values (micrograms /liter)	CBSG (micrograms /liter)
D-1	TCE	25 - 6,000	5
	cis-1,2-DCE	53 - 860	70
	trans-1,2-DCE	0.4 – 4.8	100
	1,1-DCE	Non-detect [ND] - 17	5
	VC	21 - 580	2
	NDMA	0.053 – 1.3	0.05**
SCA	TCE	40 – 1,600	5
	cis-1,2-DCE	4.8 – 640	70
	trans-1,2-DCE	ND – 26	100
	1,1-DCE	ND – 3.4	5
	VC	ND – 39	2
	NDMA	0.74 – 36	0.05**
EPL	TCE	970 – 11,000	5
	cis-1,2-DCE	6 – 1,900	70
	trans-1,2-DCE	ND – 0.74	100
	1,1-DCE	ND – 4	5
	VC	ND – 33	2
CSSA	TCE	0.19 – 170	5
	cis-1,2-DCE	ND – 19	70
	trans-1,2-DCE	ND – 0.058	100
	1,1-DCE	ND	5
	VC	ND – 14	2
	NDMA*	0.18 - 2.8	0.05**
OTL	TCE	6.2 – 15	5
	cis-1,2-DCE	6.8 – 23	70
	trans-1,2-DCE	ND	100



Table 3: Groundwater Contaminants of Concern (COC) Concentrations at the Seven Source Areas

Source Area	Contaminant	Range of Values (micrograms /liter)	CBSG (micrograms /liter)
	1,1-DCE	ND – 0.1	5
	VC	ND – 5.1	2
T-8A	TCE	110 – 480	5
	cis-1,2-DCE	5.2 – 25	70
	trans-1,2-DCE	ND – 1.2	100
	1,1-DCE	ND – 0.12	5
	VC	ND	2
	NDMA*	0.86 – 1.1	0.05**
D-4	TCE	0.27 – 90	5
	cis-1,2-DCE	ND – 13	70
	trans-1,2-DCE	ND – 2.3	100
	1,1-DCE	ND – 0.32	5
	VC	ND – 32	2

TCE concentrations from the Performance Monitoring Report, 4th Quarter, Report #7

*NDMA concentrations from Annual Groundwater program 2009 fall sampling.

**NDMA value based on the Current Practical Quantitation Limit (PQL)

Soil:

Human exposure to the residual and limited soil contaminants was assessed using soil screening levels developed following State of Colorado Tier 2 procedures (*Proposed Soil Remediation Objectives Policy Document*, State of Colorado, 1997). The Tier 2 procedures are protective of direct contact with soil and potential leaching to groundwater as a future source of contamination. The Soil Remediation Objectives (SROs) are human health risk-based concentrations applied to possible land uses, which for PJKS are industrial or commercial. The Tier 2 Soil-to-Groundwater (STG) values are calculated to ensure the CBSGs are not exceeded as a result of soil contamination. Based on the current and foreseeable land uses at PJKS, the Tier 2 Industrial SRO and the Tier 2 STGs have been selected as the cleanup criteria for the facility. The comparison of soil concentrations to these criteria resulted in the identification of select areas with residual soil contamination. Risks and exposure to these limited areas have been mitigated by the incorporation into an Operations and Maintenance (O&M) Plan (Shaw, 2010a). This includes annual site visits to check on the integrity of the covers. Land use controls (LUCs) for soils exist where concentrations exceed industrial levels and a limited cover exists.

A baseline ecological risk assessment (Parsons, 1998) and a screening risk assessment for birds (Shaw, 2005b) were also prepared to evaluate potential risk to ecological receptors. Sufficient evidence exists to conclude that further evaluation of risk to mammals or birds from chemicals detected in soil is not warranted. As a result, soil does not warrant an interim corrective measure (ICM)/interim remedial action (IRA). Thus no further action is necessary to address the evaluation of the analytical data is necessary to address ecological risk.

What are Land Use Controls?

Land use controls are various institutional (legal) and engineering measures put in place to reduce human exposure to remaining contamination. Engineering controls include physical barriers (concrete or asphalt surfaces). Examples of institutional controls are deed restrictions on the property (or environmental covenants), access limits, zoning restrictions, and permit requirements designed to ensure that engineering controls stay in place.

TECHNICAL IMPRACTICABILITY WAIVER

As part of the selected remedy, a Technical Impracticability (TI) waiver is warranted for NDMA in bedrock groundwater for the CBSG applicable or relevant and appropriate requirements (ARAR) of the specific state environmental law (State of Colorado Regulation 41, Title 5, CCR 1002-41). Past studies and research indicate that restoration of bedrock groundwater to the NDMA cleanup levels defined by the RAOs is not possible overall or portions of the contaminant plume(s) using currently available technologies. **Figure 4** illustrates the TI Zone locations. No costs are associated with this specific portion of the groundwater remedy. RAOs are expected to be achieved for other COCs.



What is in-situ bioremediation?

A technology that consists of introducing specific substrates or chemicals directly into the aquifer to enhance chemical or biological processes that degrade contaminants. Substrates are injected into the aquifer through groundwater wells, and the contaminant biodegradation occurs in the subsurface aquifer. To enhance the process for in-situ biodegradation of chlorinated solvents, microbial population growth is stimulated by artificially supplying a carbon source (substrate) such as carbohydrates (i.e., sodium lactate or emulsified edible oil).

REMEDIAL ACTION OBJECTIVES (RAOs)

RAOs are medium-specific remedial goals, or cleanup goals, developed for individual sites to protect human health and the environment.

Groundwater:

The following RAOs adequately address actual or potential risks posed by the groundwater medium:

- Reduce the concentrations of TCE in bedrock groundwater source areas to concentrations that achieve CBSGs (see **Table 3**) for groundwater that is migrating off site; and
- Reduce the TCE contamination in the downgradient portion of the source areas at the transition points (where bedrock groundwater transitions to the alluvial system).

Soil:

The following RAOs were used for analytes detected in soil to be protective in an industrial land use setting:

- Tier 2 Industrial SROs; and
- Tier 2 STGs

Table 4: Analyte specific RAOs that were not achieved at SWMUs 8, 12, 29, and 31 as well as CSA-3 and as a result require restrictive covers with land use controls.

Contaminant	Value (milligram/kilogram)
Total PCBs	0.62
PCB-1016	0.62
PCB-1254	0.62
PCB-1260	0.62

SUMMARY OF ALTERNATIVES

A Focused Feasibility Study (FFS) approach was performed to identify remedial alternatives for the seven groundwater source areas and for the alluvial groundwater migrating off the site. Existing information on remediation technologies and site characterization data were used in the FFS to eliminate technology alternatives that cannot be effectively implemented at PJKS. Identification of treatment alternatives were focused on process options that are known to be suitable for PJKS groundwater conditions. The traditional procedure of identifying general response actions, technologies, and process options through successive screening rounds in the feasibility study has instead been accomplished through previous pilot studies, bench scale studies, and research of alternative technologies. Various potential technologies, including chemical oxidation and aerobic co-metabolism were evaluated and screened out in the Pilot Study Work Plan (Shaw, 2003b). Site conditions have been fully characterized and several treatability studies and interim remedial actions have been completed resulting in only a limited number of alternatives that are practicable and realistic (EPA, 1990). These alternatives also fit the site conditions being addressed (as determined from the previously conducted remedial/site investigations), use the results from previous treatability studies and ICMS, and meet the established RAOs. A No Action alternative is also included to provide a baseline for comparison purposes pursuant to 40 CFR 300.430(e)(6).

For more details refer to the FFS located in the Administrative Record.

Groundwater:

Alternative 1 – No Action
Alternative 2 – In-Situ Bioremediation and Environmental Covenants

Soil:

The final remedies for soil sites are complete and have achieved regulatory. Therefore no alternatives for soil sites are presented in this Proposed Plan.

EVALUATION OF ALTERNATIVES

The alternatives were screened on the basis of the nine CERCLA criteria including:

- Overall Protection of Human Health and the Environment,



- Compliance with Potential ARARs,
- Long-term Effectiveness & Permanence,
- Reduction of Toxicity, Mobility, or Volume,
- Short-term Effectiveness,
- Implementability,
- Cost,
- State Acceptance, and
- Community Acceptance.

- Cost: No costs (other than 5-year reviews) are associated with this alternative. See below.
- State and Community Acceptance: Acceptance of Alternative 1 by the State and community are unlikely since Alternative one does not meet CERCLA criteria.

The FFS (Shaw, 2010c) only evaluated costs for the groundwater remedies for TCE and therefore this Proposed Plan follows the same outline. Costs for the two alternatives are presented below for the groundwater media. The estimated capital costs, O&M costs, and total present worth (in 2010 dollars) were based on a maximum 30-year remediation duration and are summarized below.

Alternative 1 Cost Analysis:

Capital Cost:	\$0
O&M Cost:	\$66,168
Total Present Worth:	\$24,000

Evaluation of Groundwater Alternatives:

Alternative 1 – No Action

Under Alternative 1, no action would be taken to change the current contaminated groundwater. This alternative was evaluated against the nine CERCLA criteria as follows:

Alternative 2 – In-Situ Bioremediation and Environmental Covenants

Under Alternative 2, in-situ bioremediation is implemented to reduce the source area contributions and an environmental covenant is enforced to be protective of the future land use above the groundwater plumes. This alternative was evaluated against the nine CERCLA criteria as follows:

- Overall Protection of Human Health and the Environment: Alternative 1 does not provide for overall protection of human health and the environment as there will be no decrease in contaminants in the source areas (other than potential natural biodegradation).
- Compliance with Potential ARARs: Alternative 1 is not compliant with the chemical-specific ARARs, specifically the CBSGs.
- Long-term Effectiveness & Permanence: Alternative 1 does not provide long-term effectiveness or permanent remedy for the groundwater contamination.
- Reduction of Toxicity, Mobility, or Volume: Alternative 1 does not reduce toxicity, mobility, or volume of contaminated groundwater at PJKS.
- Short-term Effectiveness: There are no environmental impacts to implement Alternative 1. Alternative 1 is not protective of the community and is not protective of workers who would encounter shallow groundwater during excavations.
- Implementability: No technical or administrative feasibility concerns are associated with implementing Alternative 1 because no actions are being taken.

- Overall Protection of Human Health and the Environment: Alternative 2 is protective of human health and environment because it reduces the concentrations of COCs in groundwater source areas and eliminates exposure pathways.
- Compliance with Potential ARARs: Alternative 2 would comply with all potential ARARs.
- Long-term Effectiveness & Permanence: Alternative 2 will achieve long-term effectiveness by treating groundwater contaminants through a non-reversible process of biodegradation with no waste products or residuals.
- Reduction of Toxicity, Mobility, or Volume: Alternative 2 uses in-situ biodegradation to accelerate contaminant removal and irreversibly reduce the toxicity and volume of contaminated groundwater by converting COCs to non-toxic by-products (i.e., ethene by-product from TCE degradation).
- Short-term Effectiveness: If there are no changes made to the ICM system at PJKS, there are also no environmental impacts to implement Alternative 2. However, if it is determined that additional wells need to be installed in order to expand the monitoring well or injection well network, there would be a slight increase to environmental



impacts and worker risks from well installation or other monitoring activities. Alternative 2 is protective of the community and workers because it decreases the toxicity of source areas contributing to the groundwater contamination.

- Implementability: With the exception of LUCs, Alternative 2 has already been implemented at PJKS. The property owner, Lockheed Martin, has agreed to place an Environmental Covenant on the PJKS property (PJKS Covenant) and the portion of Lockheed Martin property (Lockheed Martin Covenant) that is impacted by contaminated groundwater from PJKS.
- Cost: Alternative 2 is more expensive than Alternative 1, but is more protective overall to human health by controlling and restricting access as well as treating the source to groundwater contamination. See Below.
- State and Community Acceptance: Acceptance of Alternative 2 by the State and community is likely since Alternative 2 does meet CERCLA criteria.

Alternative 2 Cost Analysis:

Capital Cost:	\$1,067,353
O&M Cost:	\$1,282,039
Total Present Worth:	\$611,000

PREFERRED ALTERNATIVE

The USAF expects the Preferred Alternatives to satisfy the following statutory requirements of CERCLA §121 (b): (1) be protective of human health and the environment; (2) comply with the applicable or relevant and appropriate requirements (ARARs); (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

Groundwater Preferred Alternative:

Based on the evaluation in the FFS, the preferred remedial alternative is Alternative 2 – In-Situ Bioremediation and Environmental Covenants. Alternative 2 is recommended because it provides high levels of overall protection of human health by controlling and restricting access to the site and limiting potential exposure to groundwater.

Alternative 2 is considered to be more protective than Alternative 1.

The USAF will be responsible for implementing, maintaining, and monitoring the remedial action identified herein for the duration of the remedy. Specific measures to restrict access and limit exposure to groundwater will include the implementation of an Environmental Covenant as well as providing updates to the Lockheed Martin property management plan.

COMMUNITY PARTICIPATION

The USAF regularly provides the community with information regarding the cleanup at PJKS. This information is provided through regular meetings of the Restoration Advisory Board, by maintaining the public information repository and online Administrative Records, and by publishing various announcements and public notices in the local newspapers.

Formal comments on this Proposed Plan can be submitted during the public comment period or at the public hearing. The 45-day public comment period is being held from:

January 12, 2012 through February 25, 2012.

Please note that comments received outside of the public comment period are considered informal and may not receive a response. Comments may also be provided during the public hearing which will be held at 7:00 p.m. on February 8, 2012.

The USAF, CDPHE, and EPA will consider all formal comments prior to making a final decision for PJKS. All comments and responses will be documented in the Record of Decision.

For questions or additional information, please contact:

United States Air Force
Attn: Mr. Corey Lam
1-(800) 982-7248 extension 52970

United States Environmental Protection Agency
Attn: Mr. David Rathke
Rathke.David@epamail.epa.gov
(303) 312-6016

Colorado Department of Public Health and the Environment
Attn: Mr. David Walker
dwalker@cdphe.state.co.us
(303) 692-3354

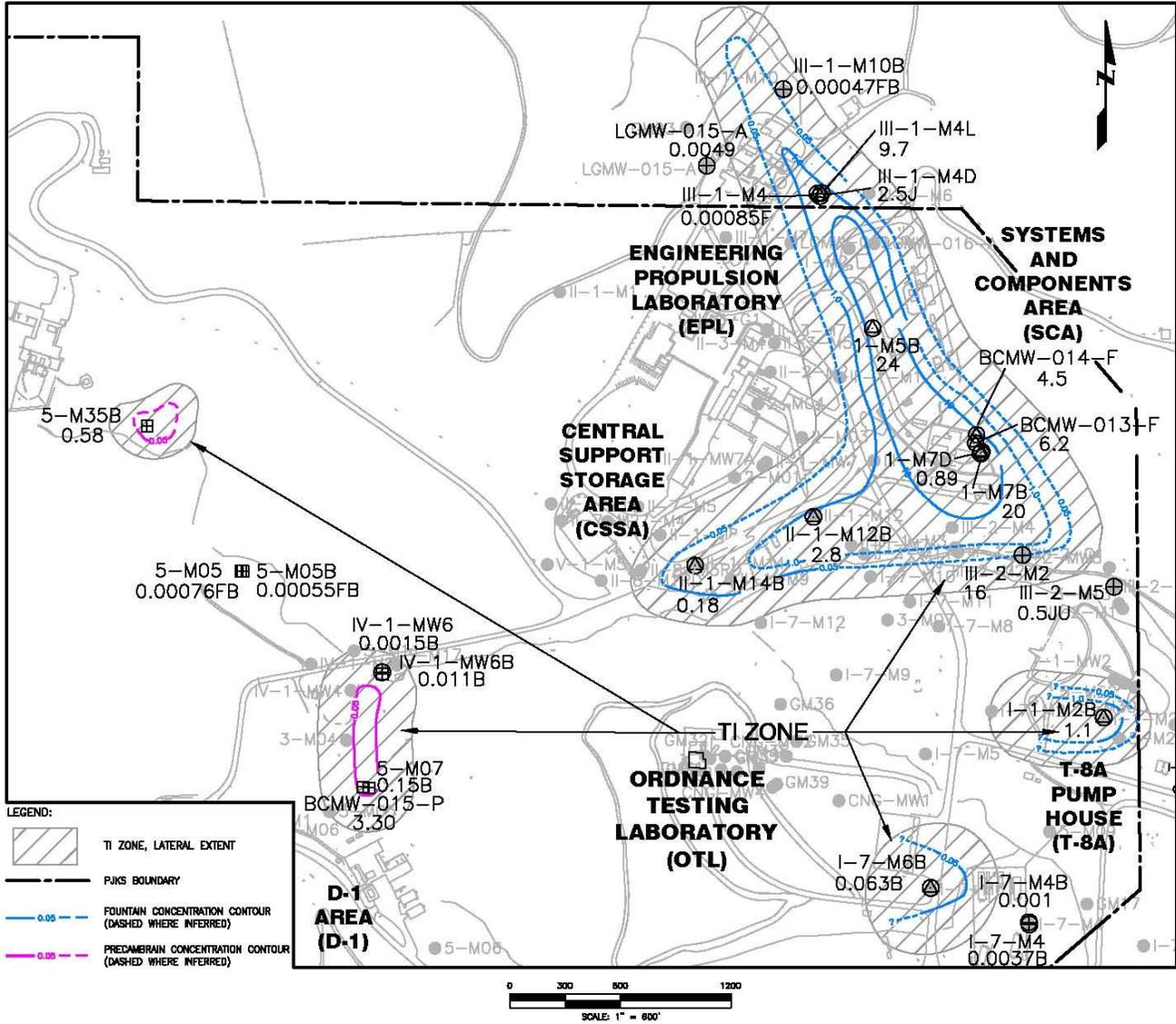


Figure 4: Technical Impracticability Zone Locations



Glossary of Terms

Specialized terms used in this Proposed Plan are defined below:

Administrative Record (AR): a collection of documents generated during the investigation of the site, which form the basis for a selection of a Final Remedy, and are placed in a central location for public review.

Environmental Covenant: a document that will specify that all of the property that comprises the PJKS site will only be used for industrial purposes and will be placed on the property soon after the final corrective measure for the entire facility has been selected and approved.

In-Situ Bioremediation: a technology that consists of introducing specific substrates or chemicals directly into the aquifer to enhance chemical or biological processes that degrade contaminants. Substrates are injected into the aquifer through groundwater wells, and the contaminant biodegradation occurs in the subsurface aquifer. To enhance the process for in-situ biodegradation of chlorinated solvents, microbial population growth is stimulated by artificially supplying a carbon source (substrate) such as carbohydrates (i.e., sodium lactate or emulsified edible oil).

Land Use Controls (LUCs): physical or legal barriers that limit human exposure to contaminated properties by restricting activity, use, and access to the properties.

Limited Cover: a physical barrier (concrete, asphalt, or an upper uncontaminated soil layer) that provides adequate cover for contaminated soil.

n-nitrosodimethylamine (NDMA): a yellow liquid with no distinct odor used to make rocket fuel. Significant exposure to NDMA can cause liver damage in humans; however little else is known about the health effects of NDMA in people.

No Further Action (NFA): a determination based upon an evaluation of historical use of the site, or of the area(s) of concern at that site, as applicable, that there are no discharged contaminants present at the site, or at any other site to which a discharge originating at the site has migrated, or that any discharged contaminants present at the site or that

have migrated from the site have been remediated in accordance with applicable remediation regulations.

Polychlorinated Biphenyls (PCBs): a group of toxic, persistent chemicals formerly used in electrical transformers and capacitors for insulation purposes. The sale and new use of these chemicals were banned by law in 1979.

Proposed Plan: a document that summarizes for the public the preferred cleanup alternative for a site and presents the rationale for the preference.

Record of Decision (ROD): a document presenting the final cleanup action selected under an agreement with the regulatory agencies.

Technical Impracticability Waiver: an evaluation available under both CERCLA and RCRA where site characteristics prohibit the engineering feasibility or reliability of a remedy to meet the ARARs. The evaluation is based on the site characteristics, contaminant characteristics, research and investigation results, bench scale treatability study results, and on-site pilot study results for NDMA degradation in bedrock groundwater.

Trichloroethene (TCE): a nonflammable, colorless liquid used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives and paint removers. Once dissolved, TCE can remain in ground water for a long time. Significant exposure to TCE may cause nausea, liver damage, impaired heart function, unconsciousness, and death.



**PROPOSED PLAN FOR FORMER USAF PLANT PJKS,
WATERTON CANYON, COLORADO
April 2011**



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